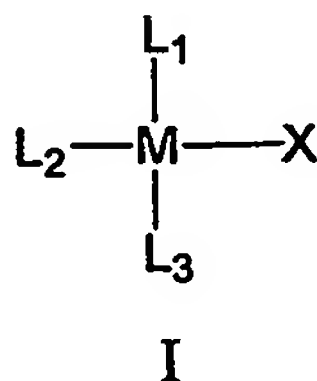


## CLAIMS

1. A complex of formula I



wherein

M is Ca, Mg, Ba or Sr;

$L_1$  is selected from  $R^1O$ ,  $R^2S$ ,  $R^3R^4N$ ,  $R^5R^6P$ , a substituted or unsubstituted cyclopentadienide and a substituted or unsubstituted pyrazolyl group, where  $R^1$ - $R^6$  are each independently H or hydrocarbyl;

$L_2$  is selected from  $R^7R^8O$ ,  $R^7R^8S$ ,  $R^7R^8R^9N$ ,  $R^7R^8C=NR^9$ ,  $PR^7R^8R^9$ , or a substituted or unsubstituted heterocycle containing one or more O, N or S atoms, where  $R^{7-9}$  are each independently H or a hydrocarbyl group; or  $L_1$  and  $L_2$  are linked to form a bidentate ligand;

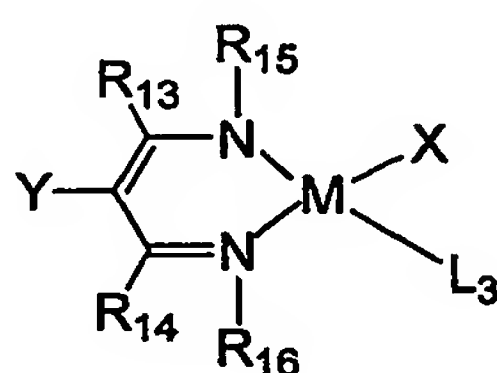
$L_3$  is absent or is a solvent molecule, or a neutral ligand as defined for  $L_2$ , wherein  $L_3$  may be the same or different to  $L_2$ ; or  $L_3$  is linked to a further metal centre; or  $L_1$ ,  $L_2$  and  $L_3$  are linked to form a tridentate ligand; and

X is an alkyl group, an aryl group, an amide group, an aryloxy or an enolate group of formula  $R^{10}R^{11}C=CR^{12}O^-$ , wherein  $R^{10-12}$  are each independently H or hydrocarbyl;

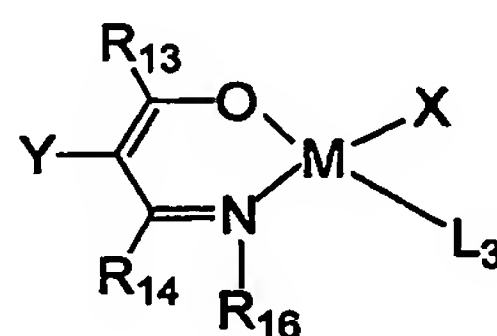
with the proviso that when  $L_1$  and  $L_2$  are  $\{HC(C(CH_3)=N-2,6\text{-}i\text{Pr}_2C_6H_3)_2\}$  and M is magnesium, X is other than Me or  $t\text{Bu}$ .

2. A complex according to claim 1 wherein  $R^1$  and  $R^2$  are hydrocarbyl, and  $R^{3-6}$  are H or hydrocarbyl.

3. A complex according to claim 1 wherein  $R^1$  and  $R^2$  are each independently selected from branched or unbranched alkyl, branched or unbranched alkenyl, or aryl, each of which may be substituted or unsubstituted.
4. A complex according to claim 1 wherein  $L_1$  and  $L_2$  are linked to form a bidentate ligand selected from a beta-diketiminate and a beta-ketoiminate.
5. A complex according to claim 4 of formula II or III



II



III

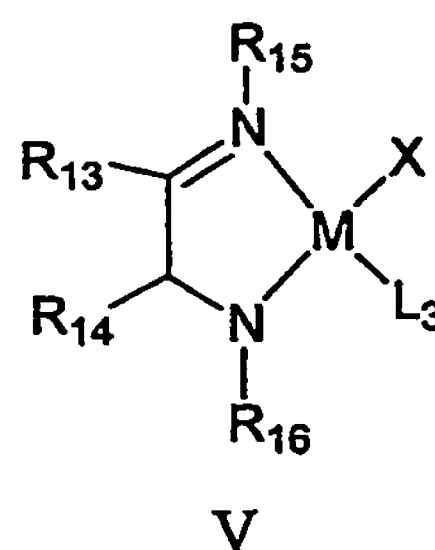
wherein

Y is H, hydrocarbyl or CN;

$R^{13-16}$  are each independently selected from H and hydrocarbyl; or Y and  $R^{13}$  are linked to form a hydrocarbyl group; and  
 $L_3$  absent or as defined in claim 1.

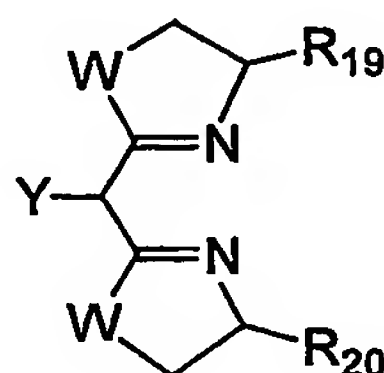
6. A complex according to claim 5 wherein  
 Y is selected from H, CN, alkyl, aryl, haloalkyl or heteroalkyl;  
 $R^{13-16}$  are each independently selected from alkyl, aryl, heteroalkyl, haloalkyl, cycloalkyl and a heterocyclic ring containing at least one O, N or S atom; or Y and  $R^{13}$  are linked to form an aryl group; and  
 $L_3$  is absent or is selected from  $R^7R^8O$ ,  $R^7R^8S$ ,  $R^7R^8R^9N$ ,  $R^7C=NR^8$ ,  $PR^7R^8R^9$ , thiophene and tetrahydrofuran, where  $R^{7-9}$  are each independently H or a hydrocarbyl group.

7. A complex according to claim 1 of formula V



wherein  $R^{13-16}$  are as defined in claim 5 or claim 6, and where  $R^{13}$  and  $R^{15}$  are optionally linked to form an aryl group.

8. A complex according to claim 1 wherein  $L_1$  and  $L_2$  form a bidentate ligand of formula VIII



VIII

wherein

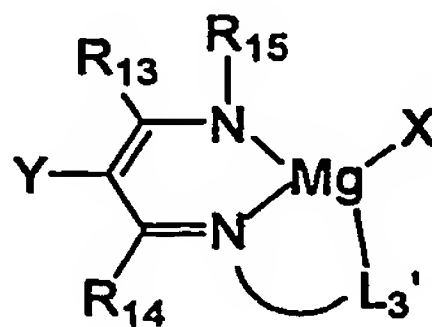
Y is as defined above;

W is O, NH,  $NR'$  or  $CH_2$  where  $R'$  is hydrocarbyl; and

$R^{19-20}$  are as defined for  $R^{13-16}$  above.

9. A complex according to any one of claims 1 to 3 wherein  $L_1$ ,  $L_2$  and  $L_3$  are linked to form a tridentate ligand.
10. A complex according to claim 9 wherein  $L_1$ ,  $L_2$  and  $L_3$  are linked to form a tridentate ligand selected from a beta-diketiminato with a pendant donor group, and a Schiff base derivative with a pendant donor arm.

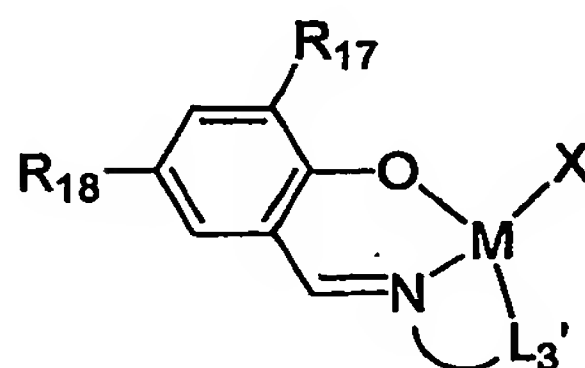
11. A complex according to claim 10 of formula VI



VI

wherein L<sub>3</sub>' is defined as for L<sub>3</sub> in claim 1, and is linked to the nitrogen of the bidentate ligand via a linker group.

12. A complex according to claim 10 wherein said complex is of formula VII

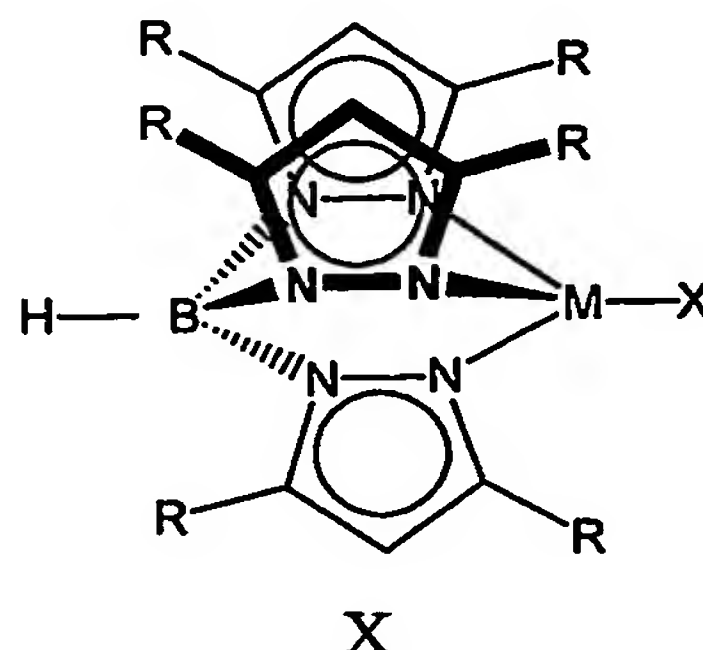


VII

wherein L<sub>3</sub>' is defined as for L<sub>3</sub> in claim 1, and is linked to the nitrogen of the bidentate ligand via a linker group, and R<sup>17-18</sup> are as defined for R<sup>13-16</sup> above.

13. A complex according to claim 11 or claim 12 wherein the linker group is (CH<sub>2</sub>)<sub>n</sub> where n is 0-6, an arylene group, or SiR<sub>2</sub>, where R is hydrocarbyl.

14. A complex according to claim 1 of formula X



wherein each R is independently H or a hydrocarbyl group.

15. A compound according to any preceding claim wherein X is an alkyl group
16. A compound according to claim 15 wherein X is  $i\text{Pr}$ .
17. A compound according to any one of claims 1 to 14 wherein X is an amide group.
18. A compound according to claim 17 wherein X is  $\text{NPr}^i_2$ .
19. A compound according to any one of claims 1 to 14 wherein X is an enolate group of formula  $\text{R}^{10}\text{R}^{11}\text{C}=\text{CR}^{12}\text{O}^-$ , wherein  $\text{R}^{10}$  and  $\text{R}^{11}$  are H and  $\text{R}^{12}$  is an aryl group.
20. A compound according to claim 19 wherein X is  $-\text{OC}(=\text{CH}_2)\text{Ar}$ , wherein Ar is 2,4,6- $\text{Me}_3\text{C}_6\text{H}_2$ .
21. A complex comprising a dimer of a complex according to any preceding claim.
22. A complex according to claim 1 selected from the following:  
 $\{\text{HC}(\text{C}(\text{CH}_3)=\text{N}-2,6\text{-}^i\text{Pr}_2\text{C}_6\text{H}_3)_2\}\text{Mg}^i\text{Pr}$  [1];  
 $[\{\text{HC}(\text{C}(\text{CH}_3)=\text{N}-2,6\text{-}^i\text{Pr}_2\text{C}_6\text{H}_3)_2\}\text{Mg}(\text{OC}(=\text{CH}_2)\text{Ar})]_2$  [2];  
 $[\{\text{HC}(\text{C}(\text{CH}_3)=\text{N}-2,6\text{-}^i\text{Pr}_2\text{C}_6\text{H}_3)_2\}\text{Mg}(\text{OC}(=\text{CH}_2)\text{Ar})\cdot\text{Et}_2\text{O}]$  [3];

wherein Ar = 2,4,6-Me<sub>3</sub>C<sub>6</sub>H<sub>2</sub>;

{HC(C(<sup>t</sup>Bu)=N-2,6-<sup>i</sup>Pr<sub>2</sub>C<sub>6</sub>H<sub>3</sub>)<sub>2</sub>)Mg(OC(=CH<sub>2</sub>)-2,4,6-Me<sub>3</sub>C<sub>6</sub>H<sub>2</sub>) [4];

{HC(C(Me)=N-2,6-<sup>i</sup>Pr<sub>2</sub>C<sub>6</sub>H<sub>3</sub>)(C(Me)=N-2-OMeC<sub>6</sub>H<sub>4</sub>)}Mg<sup>i</sup>Pr [5];

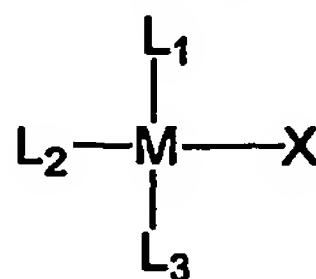
{HB(3,5-Me<sub>2</sub>C<sub>3</sub>N<sub>2</sub>H)<sub>3</sub>}Mg(OC(=CH<sub>2</sub>)-2,4,6-Me<sub>3</sub>C<sub>6</sub>H<sub>2</sub>) [6];

{HC(C(Me)=N-2,6-<sup>i</sup>Pr<sub>2</sub>C<sub>6</sub>H<sub>3</sub>)<sub>2</sub>}Ca(OC(=CH<sub>2</sub>)-2,4,6-Me<sub>3</sub>C<sub>6</sub>H<sub>2</sub>)•THF [7];

[{HC(C(Me)=N-2,6-<sup>i</sup>Pr<sub>2</sub>C<sub>6</sub>H<sub>3</sub>)<sub>2</sub>}Ca(OC(=CH<sub>2</sub>)-2,4,6-Me<sub>3</sub>C<sub>6</sub>H<sub>2</sub>)]<sub>n</sub> [8] where n = 1 or 2; and

{HC(C(CH<sub>3</sub>)=N-2,6-<sup>i</sup>Pr<sub>2</sub>C<sub>6</sub>H<sub>3</sub>)<sub>2</sub>}MgNPr<sup>i</sup><sub>2</sub> [9].

23. Use of a complex of formula Ia as a polymerisation initiator,



Ia

wherein

M is Ca, Mg, Ba or Sr;

L<sub>1</sub> is selected from R<sup>1</sup>O, R<sup>2</sup>S, R<sup>3</sup>R<sup>4</sup>N, R<sup>5</sup>R<sup>6</sup>P, a substituted or unsubstituted cyclopentadienide, and a substituted or unsubstituted pyrazolyl group, where R<sup>1-6</sup> are each independently H or hydrocarbyl;

L<sub>2</sub> is selected from R<sup>7</sup>R<sup>8</sup>O, R<sup>7</sup>R<sup>8</sup>S, R<sup>7</sup>R<sup>8</sup>R<sup>9</sup>N, R<sup>7</sup>R<sup>8</sup>C=NR<sup>9</sup>, PR<sup>7</sup>R<sup>8</sup>R<sup>9</sup>, and a substituted or unsubstituted heterocycle containing one or more O, N or S atoms, where R<sup>7-9</sup> are each independently H or a hydrocarbyl group; or L<sub>1</sub> and L<sub>2</sub> are linked to form a bidentate ligand;

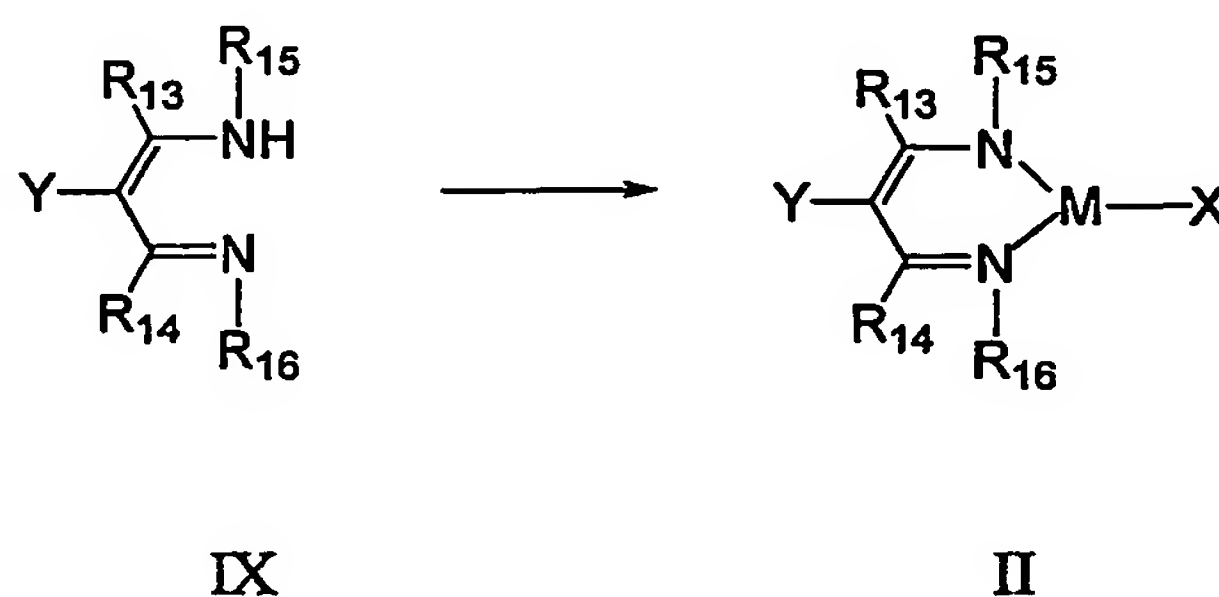
L<sub>3</sub> is absent or is a solvent molecule, or a neutral ligand as defined for L<sub>2</sub>, wherein L<sub>3</sub> may be the same or different to L<sub>2</sub>; or L<sub>3</sub> is linked to a further metal centre; or L<sub>1</sub>, L<sub>2</sub> and L<sub>3</sub> are linked to form a tridentate ligand; and

X is an alkyl group, an aryl group, an amide group, or an enolate group of formula R<sup>10</sup>R<sup>11</sup>C=CR<sup>12</sup>O<sup>-</sup>, wherein R<sup>10-12</sup> are each independently H or hydrocarbyl;

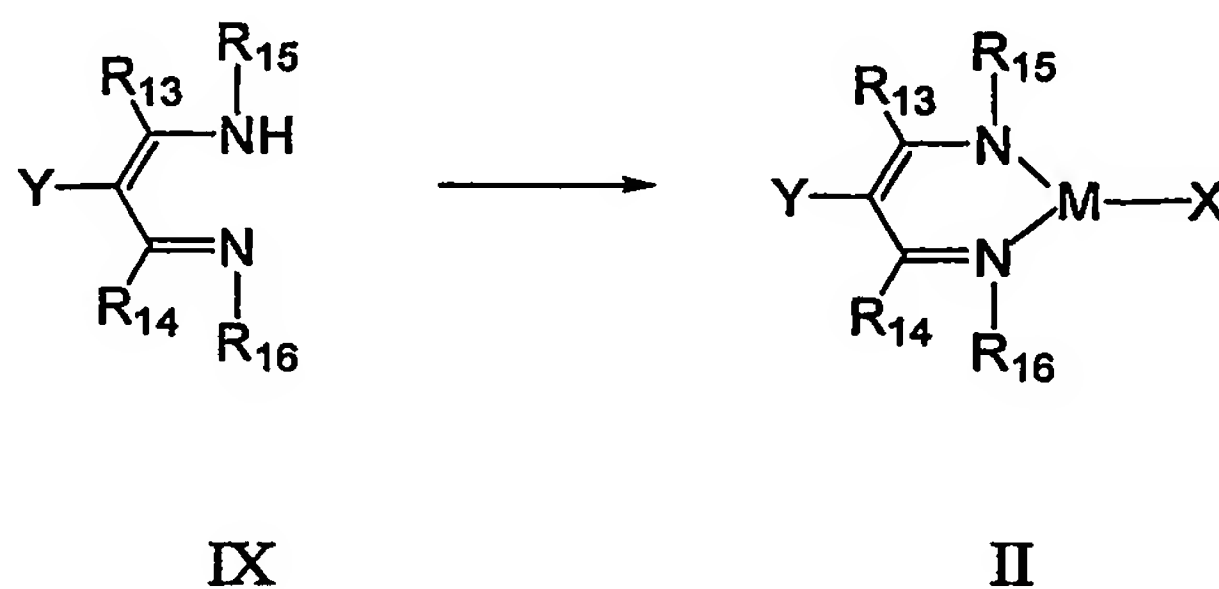
with the proviso that when  $L_1$  and  $L_2$  are  $\{HC(C(CH_3)=N-2,6-iPr_2C_6H_3)_2\}$ , M is magnesium, X is other than Me or  $tBu$ .

24. Use according to claim 23 in the polymerisation of acrylate and/or alkyl acrylate monomers.
25. Use according to claim 23 or 24 which further comprises the use of a chain transfer reagent.
26. A process for the polymerisation of acrylate and/or alkylacrylate monomers, said process comprising contacting an initiating amount of a complex of formula Ia as defined in claim 23 with an acrylate and/or an alkylacrylate monomer in the presence of a suitable solvent.
27. A process according to claim 26 wherein the ratio of monomer to the complex is between 10:1 and  $10^6:1$ .
28. An article prepared by a process according to claims 26 or 27.
29. A composition comprising an acrylate and/or an alkylacrylate monomer and a complex of formula Ia as defined in claim 23.
30. A composition comprising poly(alkylacrylate) and poly(alkylmethacrylate) or copolymers thereof, and a complex of formula Ia as defined in claim 23.

31. A process for preparing a complex of formula II as defined in claim 5, where X is alkyl, said process comprising reacting a compound of formula IX with (a)  $^n\text{BuLi}$ , and (b)  $\text{XMgCl}$



32. A process for preparing a complex of formula II as defined in claim 5, where X is alkyl, said process comprising reacting a compound of formula IX with  $\text{MgX}_2$



33. A process for preparing a complex of formula II, as defined in claim 5, where X is an enolate group of formula  $\text{R}^{10}\text{R}^{11}\text{C}=\text{CR}^{12}\text{O}^-$ , said process comprising reacting the product obtained from the process of claim 31 or claim 32 with a compound of formula  $\text{HR}^{10}\text{R}^{11}\text{C}-\text{C}(\text{O})\text{R}^{12}$ .
34. A method for producing polymethacrylate having greater than 75% syndiotacticity, said method comprising contacting methacrylate monomer with a complex of formula Ia as defined in claim 23 in the presence of a suitable solvent.



34

35. A method according to claim 34 which is carried out at a temperature in excess of  $-40^{\circ}\text{C}$ .